WE CLAIM:

1. In a power sharing system in a DC load environment having:

a source of AC;

an alternative source of DC;

a power controller capable of inputting voltage regulated DC power simultaneously from said sources, said alternative source of DC making a shared contribution of power selected by said power controller, and having a power junction means for delivering a regulated voltage DC to a DC compatible load at an output of said power sharing system;

said power controller controlling supply side power sharing to a DC load side;

said power controller having a converter converting AC inputted electrical power into a defined DC-regulated voltage to provide and manage power to said DC compatible load;

said power controller producing voltage regulated power by controlling response of said alternative source of DC power;

said power controller capable of altering the output voltage of said power junction means for directing power from said secondary sources of DC power to limit peak power supplied from said source of AC power to said DC compatible load in accordance with a pre-set threshold of power from said source of AC power in order to minimize peak power surcharges; wherein the improvement comprises:

means for operating said alternative source of DC in a dynamic manner that allows the utilization of all the power generating capability at the specific operating conditions of the moment; and,

means for delivering power from said alternative primary power source of DC in excess of that required by said DC compatible load back to said source of AC.

2. The power system of Claim 1 wherein said DC compatible load is selected from the group consisting of:

a lighting system,

a DC power consumption device;

a lighting ballast;

a lamp;

solid state lighting;

a DC motor;

an AC motor with variable frequency drive (VFD); and/or

an inverter.

3. The power system of Claim 1 further comprising an external DC source being is an energy storage device.

4. The power system of Claim 1 wherein said alternative source of DC is at least one of a photo voltaic energy source, a cogenerator, a wind energy conversion system and/or a fuel cell.

5. The power system of Claim 1 wherein said source of AC is at least one of a utility AC grid; a generator and/or a stand alone inverter with a connected DC source.

6. The power system as in Claim 3 in which said power controller contains circuitry for combining power from said alternative source of DC and said external DC energy storage device, in the absence of power from said source of AC.

7. The power sharing system as in claim 6 further comprising a means to stop delivering of said DC to said AC source when said source of AC power is off and not present.

8. A power sharing system in a DC load environment including:

a source of AC;

an alternative source of DC;

said power sharing system comprising:

a bi-directional isolated power supply for converting power from said source of AC to DC power;

means for operating said alternative source of DC in a dynamic manner that allows the utilization of all the power generating capability at the specific operating conditions of the moment of said alternative source of DC;

a DC compatible load;

a converter for transforming the output of said alternative source of DC to a voltage level suitable for use by said DC compatible load;

a metering module for receiving data relating to power from said converter; providing data to a digital processor to control said bi-directional isolated power supply, to provide power for supplementing power insufficiency delivered by said converter, thereby supplying load requirements of said DC compatible load, and,

said power system module including means for feeding back to said source of AC, through said bi-directional isolated power supply, power delivered by said converter, in excess of that required by said DC compatible load at any given time.

9. The power system of Claim 8 wherein said DC compatible load is selected from the group consisting of:

a lighting system;

a DC power consumption device;

a lighting ballast;

a lamp;

solid state lighting;

a DC motor;

an AC motor with variable frequency drive (VFD); and/or

an inverter.

10. The power system of Claim 8 further comprising an external DC energy storage device.

11. The power sharing system of claim 8 in which said alternative source of DC is at least one of a photovoltaic energy source, a wind energy conversion system, a cogenerator and/or a fuel cell.

12. The power system of Claim 8 wherein said source of AC is at least one of a utility AC grid; a generator and/or a stand alone inverter with a connected DC source.

13. The power sharing system of Claim 8 having a battery backup system to supply DC power to said DC compatible load when there is a failure in said source of AC and said alternative source of DC produces insufficient power for said DC compatible load;

said system having a means for feeding back AC power from said external DC energy storage device into an AC input connection.

14. The power sharing system as in Claim 8 further comprising a means to prevent feeding back of said AC, when said source of AC power is turned off.

15. A multiple bi-directional input/output power control system comprising:

at least one power control unit having a network of functional blocks housed in a single enclosure, said unit providing DC power to at least one DC load,

said unit providing control and internal pathways sharing a plurality of power inputs, said inputs including:

an AC power source,

at least one alternative DC power source, and,

said unit having a means for feeding back AC power from said at least one DC power source into an AC input connection.

16. The multiple bi-directional input/output power control system as in Claim 15 further comprising at least one external DC energy storage device.

17. The multiple bi-directional input/output power control system as in claim 15 wherein said at least one power control unit is a plurality of interconnected power control units.

18. The multiple bi-directional input/output power control system as in claim 15 where said functional blocks are selected from the group consisting of:

at least one hard wired electronic circuit board;

software running on an internal digital processor, and/or

as a combination thereof.

19. The multiple bi-directional input/output power control system as in claim 15 wherein said network of functional blocks includes a digital processor, a low voltage ON/OFF control block, an alternate DC source DC/DC converter, a DC isolation block, and a bi-directional AC/DC power supply with a bi-directional control module, power factor correction means, an anti-islanding control block, and metering network including metering control module wherein:

said digital processor controls said functional blocks and gathers data from said metering network and metering control module;

said alternate DC source DC/DC converter conditions output of connected alternate source to match power requirements of said DC load;

said low voltage on/off control block permits direct external control of said DC isolation and said alternate DC source DC/DC converter; and,

said bi-directional AC/DC power supply providing connection to said source of AC for at least one of the following functions:

to provide power, with said power factor correction means to said DC connected load, and/or

to feed back AC power as directed by said bi-directional control module, with conditioning intervention by said power factor correction means, and safety interlock control by said anti-islanding control block.

20. The multiple bi-directional input/out power control system as in claim 16 wherein said at least one power control unit operates said alternative DC power source in conjunction with said AC source of power and/or said external DC energy storage device, in a dynamic manner allowing maximum power generating capability of said alternative DC power source at specific operating conditions of the moment.

21. The multiple bi-directional input/output power control unit as in claim 19 wherein said power control unit delivers power, in excess of that required by said at least one compatible load, to said AC power source, said external DC energy storage device, and/or a combination thereof both in a shared manner.

22. The multiple bi-directional input/output power control unit as in claim 15 wherein said means for feeding back AC power comprises a bi-directional microprocessor-controlled power supply.

23. The multiple bi-directional input/output power control unit as in claim 19 wherein said DC-to-DC Converter is a buck/boost converter with dynamic voltage controls.

24. The multiple bi-directional input/output power control unit as in claim 15 further comprising a DC-based meter,

said meter monitoring at least one of:

AC input/output,
DC input/output, and/or,
internal voltages and currents.

25. The multiple bi-directional input/output power control unit as in claim 19 wherein said bi-directional AC/DC power supply includes an AC/DC converter receiving at least one signal from said digital processor, and performing at least one function of the following functions:

1) rectifying AC and providing regulated DC voltage via DC isolation when required by said at least one DC load and/or said alternate DC power source;

2) rectifying AC and providing regulated DC voltage to said external DC energy storage device; and,

3) inverting DC power from said alternate DC power source or said external DC energy storage device and sending said DC power back to said AC power source.

26. The multiple bi-directional input/output power control system as in claim 19 wherein said power factor correction means adjusts a power factor of said power control unit to a pre-determined specified value.

27. The multiple bi-directional input/output power control system as in claim 19 wherein said anti-islanding means includes an analog and/or digital logic circuit detecting loss of connection to said AC power source grid and/or external synchronization source.

28. The multiple bi-directional input/output power control system as in claim 19 wherein said bi-directional control module includes an analog and/or digital logic device enabling said bi-directional power supply to invert DC power.

29. The multiple bi-directional input/output power control system as in claim 19 wherein said DC isolation block means electrically isolates DC output from said AC power source.

30. The multiple bi-directional input/output power control system as in claim 15 wherein said at least one DC load is selected from the group consisting of:

a lighting system;

a DC power consumption device;

a lighting ballast;

a lamp;

solid state lighting;

a DC motor;

an AC motor with variable frequency drive (VFD); and/or

an inverter.

31. The multiple bi-directional input/output power control system as in claim 19 wherein said low voltage ON/OFF control shuts down all output circuits via at least one of a low voltage signal and/or a wireless communication device.

32. The multiple bi-directional input/output power control system as in claim 19 wherein said low voltage ON/OFF control includes at least one variable signal dynamically controlling voltage of said output circuits.

33. The multiple bi-directional input/output power control system as in claim 19 wherein said alternate DC source DC/DC converter converts output of an alternate energy source to a voltage level suitable for said at least one DC load, said converter dynamically changing operating characteristics of said alternative energy source, permitting optimization of power transfer and/or permitting interface with said alternative DC energy source.

34. The multiple bi-directional input/output power control system as in claim 15 wherein said alternative DC energy source is at least one of:

a photovoltaic (PV) device,

a wind turbine,

a fuel cell, and/or

an engine driven cogeneration device.

35. The multiple bi-directional input/output power control system as in claim 16 wherein said external energy storage device stores DC power and supplies power to said at least one DC load and/or alternate energy source.

36. The multiple bi-directional input/output power control system as in claim 19 wherein said digital processor monitors and controls power delivery to and from a plurality of power sources and loads, said digital processor providing an interface for providing data and receiving control signals from an external central data acquisition and control unit.

37. The multiple bi-directional input/output power control system as in claim 19 wherein said digital processor provides at least one of:

1) dynamic voltage control and/or current control supplied by an alternate DC Source;

2) an ON/OFF control of all output circuits;

3) an ON/OFF control for the bi-directional AC/DC power Supply;

4) dynamically change output voltage; and

5) dynamically change voltage of the DC link.

38. The multiple bi-directional input/output power control system as in claim 19 wherein said digital processor controls providing at least one of:

1) volts, amps, and/or power delivered/supplied by the bi-directional AC/DC power supply;

2) volts, amps, and/or power delivered/supplied by the alternate DC source;

3) volts, amps, and/or power delivered/supplied by the external energy storage device;

4) volts, amps, and/or power delivered/supplied by the load; and/or;

5) system status, alarms and/or operating mode status.

39. The multiple bi-directional input/output power control system as in claim 36 wherein said central data acquisition and control unit provides central control and data collection of data from said multiple power units, via each respective digital processor.

40. The multiple bi-directional input/output power control system as in claim 19 wherein said bi-directional power supply is transformer isolated and includes a bridge topology permitting its operation as both a synchronous rectifier for supplying DC power and an inverter supplying AC power at its input from DC sources.

41. The multiple bi-directional input/output power control system as in Claim 40 wherein said bridge topology includes at least one of:

a MOFSET switch and/or

an insulated gate bipolar transistor (IGBT).

42. The multiple bi-directional input/output power control system as in claim 39 wherein said central data acquisition and control unit includes an enterprise level digital processor monitoring and controlling operation from a central location, soliciting sensor information from each power control unit, said central data acquisition and control unit monitoring loading of

said AC utility power source line to said enterprise, controlling each said power control unit to limit the peak utility power used, by adaptively sharing power available with requirements of said at least one DC load, thereby reducing peak surcharges.

43. A multiple bi-directional input/output power control system comprising a network of functional blocks housed in a single enclosure, said system providing DC power to at least one DC load, said system providing control and internal pathways sharing at least one of a plurality of AC and/or DC power inputs,

said system feeding back AC power from said at least one DC power source into an AC input connection, said fed-back AC power shared by other AC loads,

said system operating at least one alternative source of DC in a dynamic manner allowing maximization of power generating capability at respective specific operating conditions of the moment.